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GALTON LABORATORY FOR NATIONAL EUGENICS

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On the Marriage of First Cousins

BY

ETHEL M. ELDERTON

GALTON RESEARCH SCHOLAR

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ON THE MARRIAGE OF FIRST COUSINS

THE question of kinship in marriage, within what degrees it should be permitted, and whether near of kin should be allowed and even encouraged to marry has attracted attention and provoked discussion from very early times.

Reasoned objection to marriages of near kin on the grounds of harm to the offspring, however, seems to be of relatively late growth. Plato, in the *Laws*, says that the reason why such marriages are forbidden (he is referring to the marriage of brother and sister) is simply habit and custom, as were such marriages allowed people would marry those most like themselves, which would prevent the proper mixture of character and property.

It is very difficult to discover the law in early Rome as to the marriage of kin; according to Plutarch, even the marriage of first cousins was prohibited among the early Romans; in later times such marriages were certainly allowed. The Emperor Theodosius I (A. D. 379-95) brought in a law that no man might marry his cousin, and the penalty for so doing was death by burning and confiscation of his property. From the time of Theodosius constant changes seem to have taken place in the law with regard to cousin marriages, and as late as the ninth century the prohibited degrees seem to have been unsettled, and the grade within which marriage was forbidden was constantly changed by the Church until the year 1215, when by the fourth Lateran Council marriage was permitted outside the fourth canonical degree, that is to say marriage was

permitted to those less closely related than third cousins, and such is the nominal rule now wherever canon law is in force. This same law was in force in England until the reign of Henry VIII, when the prohibited degrees were declared to be the same as those mentioned in Leviticus, including a wife's sister. This part of the Act of Henry VIII was repealed in the reign of Mary, and the question of prohibited degrees was not settled until the reign of Elizabeth. In 1563 Archbishop Parker, on his own authority, issued a table containing the prohibited degrees, which was set up in the churches, and in 1603 this table received authority in the ecclesiastical courts. The civil law, then, at the present time permits the marriage of first cousins, and the canon law forbids the marriages of first, second, and third cousins; but where canon law is in force, as in Spain and Portugal, dispensations can be obtained without much difficulty. In some countries where the civil law is in force cousin marriages are nevertheless discouraged, as in most of those parts of Ireland where Roman Catholic influence is predominant.

In the United States we find that the feeling against cousin marriage is very strong, and in sixteen states marriage between first cousins is prohibited, and in four of these states, Ohio, Indiana, Nevada, and Washington, the prohibition is extended to first cousins once removed.

In the less civilized parts of the world we find the greatest divergence in practice; without considering those countries where nearer of kin are allowed to marry we find first-cousin marriages are absolutely forbidden in some countries, in other countries cousin marriages are allowed on the father's or on the mother's side only, while elsewhere children of a brother and

sister may marry but not the children of two brothers or two sisters.

It would seem, then, that we are here concerned with divergent human experiences, unconsciously formulated as to the relative value of endogamy and exogamy. But because the objection was not consciously formulated it is still probable that among many races the prohibition of the marriage of near kin arose from unconsciously formulated experience of its ill effects, physiological or social. Plato, when he talks about the 'mixture of character', is really recognizing the hereditary nature of 'character', and the reader at once asks why the mixture of *different* characters is desirable, if the two *like* characters to be blended are of high social value? If the patent characters of the parents were all that reappeared in the offspring, the marriage of near kin would be an easy problem, for the solution would consist in prohibition where the patent like characters were of small or even anti-social value, and in encouragement where the like characters were of marked social worth. Thus simply, however, the problem of cousin marriage is not to be answered. It is easy to recommend that stocks in which insanity, mental defect, the tubercular diathesis or neurosis are prevalent should not marry in; this is only a phase of the broader recommendation that any two such stocks should not intermarry, or indeed that they should refrain wholly from marriage. The peculiarity of cousin marriage lies in the appearance of defects in the offspring of apparently normal cousins, and the problem before us lies in the question whether this is a real peculiarity, i.e. is more frequent with normal cousins than with marriage of normals of different strains. It

may be that our attention is concentrated on cousins who produce defective offspring because of the existing religious prohibitions of kin-marriages.[1] It will thus be seen that the true problem of cousin marriage is much more subtle than the mere heredity of patent defects—it is the problem of the occurrence of *like* latencies becoming patencies in the offspring. Both theoretical and experimental investigations seem to show that the inheritance of a latent character follows the same law as the inheritance of a patent character, and accordingly the intensity of resemblance between patent characters will provide us with a measure of the intensity of resemblance in latent characters.

Let us consider for a moment these patencies and latencies from the standpoint of Mendelian theory. The possession of a character detrimental to an individual would, at least in primitive communities, be generally speaking a hindrance to marriage. Hence, as a rule, we must classify such a detrimental character as recedent in the Mendelian sense, otherwise selection would have weeded it out. Now suppose that in a population of dominants, that is of normal people, one of these dominants mates with a recedent, that is with an individual possessing some detrimental character. In all the children the detrimental character will be latent. The next generation will be obtained by the mating of these children in which the detrimental character is latent with members of the population of dominant character,

[1] Such prohibitions are not *a priori* to be discarded because they have no foundation in formulated knowledge. Folk custom always means folk experience, either experience out of date because it belongs to a past stage of development or environment, or unformulated truth still of high value. It is the first duty of science to question the validity of existing folk customs, but not to discard them without first thoroughly investigating their social worth.

and the result will be a stock of equal numbers of dominants without the detrimental character and of apparent dominants who have the detrimental character latent. Now if the 50 % dominants who have the latent detrimental character mate with their cousins of the same kind, the marriage of these cousins will have as baneful a result as a brother-sister marriage of the same generation; in each case we should get 25 % of the offspring hale, 25 % with the detrimental character patent, and 50 % of the offspring with the detrimental character latent. It therefore follows that it would be as detrimental for *some* cousins to marry as for *all* brothers and sisters. Thus the explanation of the widespread social feeling against endogamy in the first degree, even between apparently hale individuals, is on the surface explicable on the Mendelian theory.

However, this is to look on one side only of the picture, because a recedent character might possibly in some cases be a good quality introduced from outside into a population; in such a case a cousin marriage would be distinctly an advantage and a brother-sister marriage would be better still. But our experience does not indicate that many socially advantageous qualities are really recessive.

In this way the endogamy of many early communities receives its sanction. It is probable that whenever selection is very stringent, as in many early communities, the relative advantages of endogamy become apparent and are emphasized by tribal custom, but when selection is lessened and a detrimental characteristic is no longer a hindrance to marriage the other side of the picture is the more obvious.

We cannot, however, test this theory on man;

Mendelians tell us that we can only discover by breeding which members of a community are true dominants and which are apparent dominants with the recedent character latent, and therefore the somatic (or apparent) characters of the individual and of his ancestry are our sole possible guide to his gametic constitution.

There is little doubt that if any one were to collect a large number of cases of cousin marriage and examine the children, he would find that in some cases the results of a cousin marriage were disastrous, while in other cases the children would be found to be quite normal, and it is this fact which greatly adds to the difficulty of deducing results from existing statistics; in many cases they have been collected with the *a priori* object of proving either the advantage or the disadvantage of cousin marriages. The only way to collect statistics that are of any use is to collect them at random and with no theory to be proved or disproved in the mind of the collector; any personal bias is bound to show itself, even against the will of the collector, and the only way to guard against such a bias is to collect pedigrees on a large scale and indiscriminately, and to use all the pedigrees so obtained.

It is important to state definitely that in this paper we are dealing, not with what may happen in any particular case, but with what happens generally and on an average in a large number of cases. Exceptions from the general rule will occur, and it is well to emphasize the fact that one cannot foretell from the general rule what will happen in a particular case, only what will happen on the average. In social conduct, however, the average must dictate the rule.

The guiding principle in forbidding marriage between certain near kin is apparently the closeness of the degree of resemblance in character between such persons, and therefore the first step in the investigation of our problem seems to be to find out how nearly cousins do resemble one another. Marriages are forbidden in the more civilized communities between brother and sister, between uncle and niece and aunt and nephew, and between grandparent and grandchild.

Are cousins as much alike as any of these pairs of relatives? Because if so it would seem that the law which forbids the marriage of the one should forbid the marriage of the other. The investigation of the degree of resemblance of collaterals was the first problem attacked by the workers in the Biometric and Eugenics Laboratories. The degree of resemblance between brother and sister was first investigated for many characters, both mental and physical. It was found that this resemblance was equal or only very slightly greater than that of parent and child—being represented by a correlation coefficient of about ·5.[1] This near equality of parental and fraternal correlation had of course something paradoxical about it, for it is obvious that the resemblance of parent and child has an apparent disturbing factor in the influence of the second parent, while brother and sister have both parents in common. To test the point, further investigations were made into the degree of resemblance of first cousins and of uncle and aunt to nephew and niece.

To investigate the question of the resemblance of first cousins, some eight years ago Prof. Pearson set on foot an inquiry as to their physical and psycho-

[1] See Lecture I of this series.

logical characteristics. Two independent collections of statistics were started.

One of these collections deals with physical measurements on the hand, with hair and eye colour, and with general health; the hand was chosen as being capable of fairly accurate measurement, and it was thought it would be interesting to deal with some physical character that had not been dealt with hitherto from the point of view of inheritance. It was soon found that we had miscalculated the ease with which pairs of cousins could be found and measured, and we have now only just over 500 pairs; we must have many more before we can do any completely satisfactory work on these statistics. We are most grateful to all those who have helped and are helping, and shall be thankful to any who will help us further—we have spanners and colour scales which we will gladly lend to any reader who will undertake to measure pairs of adult first cousins.

The other collection consists at present of about 400 family histories which contain, in most cases, very full particulars of ancestors and collaterals, and it is from these records that our statistics are taken. The characters observed were the following:—

(1) Present Age, or Age at Death of Individual.

(2) Ailments in Life.

(3) Cause of Death, if dead.

(4) General Health under the Categories: *Very Robust*, *Robust*, *Normally Healthy*, *Delicate*, and *Very Delicate.*

(5) Ability under the categories:

A.—*Mentally Defective.*—Capable of holding in the mind only the simplest facts, and incapable of perceiving or reasoning about the relationship between facts.

B.—*Slow Dull.*—Capable of perceiving relationship between facts in some few fields with long and continuous effort; but not generally or without much assistance.

C.—*Slow.*—Very slow in thought generally, but with time understanding is reached.

D.—*Slow Intelligent.*—Slow generally, although possibly more rapid in certain fields; quite sure of knowledge when once acquired.

E_1.—*Fairly Intelligent.*—Ready to grasp, and capable of perceiving facts in most fields; capable of understanding without much effort.

E_2.—*Distinctly Capable.*—A mind quick in perception and in reasoning rightly about the perceived.

F.—*Very Able.*—Quite exceptionally able intellectually, as evidenced either by the person's career or by consensus of opinion of acquaintances.

During a part of the investigation E_1 and E_2 were classed together as E, but a large number of D–E and E–F entries (i.e. Betwixt entries) occurring, this category of E was divided as above into E_1 and E_2.

(6) Temper under the categories: *Sullen Temper, Quick Temper, Even Temper, Weak Temper* (not 'even' but weak good nature).

(7) Temperament—under three divisions (*a*) *Reserved, Expressive* or Betwixt; (*b*) *Sympathetic, Callous* or Betwixt; (*c*) *Excitable, Calm* or Betwixt.

(8) Success in Life under the categories: *Marked success*: An individual who is not only marked above his family, but above his fellow citizens for achievement in life. One who has made a name which would find a place in the *Dictionary of National Biography*. *Prosperous Career*: An individual who has advanced beyond his family level but not necessarily marked among his fellow men. An active successful life or career. *Average Career*: An individual who has not fallen below the family standard of life, whether in profession, trade or craft. *Difficult Career*: An individual who has found it difficult to maintain the previous family standard. One who has had a struggling and unprosperous career. *Failure*: An individual who has more or less failed in life; a bankrupt, or ne'er-do-well; this category may be used to cover the black sheep of a family.

We had roughly fourteen hundred pairs of male cousins, and about the same number of female cousins, and nearly three thousand male-female pairs in the health, intelligence, and temper tables, but when we were considering success in life and temperament the number of pairs were considerably less.

The results, expressed by the correlation coefficient,[1]

[1] The coefficient of correlation measures the amount of resemblance or association between characteristics of individuals or of things; it is

for the different characters are given in the following table:—

RESEMBLANCE OF FIRST COUSINS.

	Health	Intelligence	Success	Temper	Temperament	Means
Male . . .	·31	·34	·19	·18	·26	·26
Female . .	·33	·34	·26	·19	·23	·26
Male-Female	·30	·34	·26	·25	·27	·28
Means .	·31	·34	·24	·21	·25	·265

We see from this table that there is some variation in the results found for the different characters; the highest values are found for health and intelligence and the lowest for temper. The mean value is ·265. I should be inclined to attribute some of this variation to the difficulty of estimating psychical characters. This difficulty was obviously greatest in estimating temperament and success; in many cases where information is given about the health and intelligence of cousins there is no entry under the headings 'temperament' and 'success'. In the more easily measurable characters, i.e. health and intelligence, we get a higher value than for the less easily measured, and the few forms we have for definite measurements on the hand and for eye colour seem to confirm this value. At present it is safer to use the mean value, ·265, for comparative purposes; it will be some time before we can tell

represented by a decimal which lies between 0 and 1. As the correlation coefficient rises to 1 we approach a condition of absolute association. As it falls to 0 we approach a condition of absolute independence. Thus the correlation between right and left femur in man is ·96, which is practically unity, i.e. almost perfect association, as we should expect. The inheritance of stature between father and son is ·51, half-way between absolute dependence and absolute independence.

whether a higher value of about ·3 is the more accurate measure of the resemblance of first cousins.

We must now compare the resemblance we have found for cousins with that between persons whose marriage is forbidden, that is to say with the closeness of resemblance between brothers and sisters, between grandparent and grandchild, and between uncle and niece and aunt and nephew.

The mean coefficient of correlation found by different investigators for the resemblance between brother-sister pairs is ·51, not quite double the resemblance we found for cousins.

This is very much what we should expect, that the resemblance between cousins is about half what it is between brothers, but I ought to point out that the data for cousins and brother-sister pairs are neither from the same records nor for the same range of characters. In the case of the sibships twenty-one values were for definitely measurable characters, while in the cousinships there is not a single measurable characteristic cited above.

The only grandparental data at present reduced for man are those for eye colour, which give a mean value of ·32, which is roughly equal to the value found for health and intelligence in cousins, but higher than the mean of all the characters for cousins. The comparison must wait for a full discussion until we have sufficient material to find the grandparental resemblance from the family records.

We can now examine the resemblance between uncle and niece and aunt and nephew. When these cousin results were worked out the only results for the resemblance between uncles and aunts and nephews

and nieces with which we could compare them were those found by Prof. Pearson for eye colour. But more recently we have found the correlation coefficients for these relatives from the family records, so we are now in a position to compare them with the results we have obtained for cousins.

The table of the correlation coefficients is given below.

	Eye colour[1]	Health	Intelligence	Temper	Success	Temperament[2]	Means[3]
Paternal Uncle and Nephew	·32	·26	·24	·18	·14	·34	·23
Maternal Uncle and Nephew	·32	·28	·33	·18	·20	·22	·24
Paternal Aunt and Nephew	·30	·23	·34	·15	·21	·20	·23
Maternal Aunt and Nephew	·28	·30	·23	·15	·23	·30	·24
Paternal Uncle and Niece .	·27	·25	·21	·12	·16	·38	·22
Maternal Uncle and Niece .	·21	·24	·29	·17	·19	·21	·22
Paternal Aunt and Niece .	·25	·20	·40	·21	·28	·25	·27
Maternal Aunt and Niece .	·24	·26	·31	·22	·13	·27	·24
Means . .	·27	·25	·29	·17	·19	·27	·24

We see in this table much the same variation in the results as we saw in the cousin data. The higher values are found in the health and intelligence categories, and this higher result is confirmed by that found by Prof. Pearson for eye colour[4]—which is a character more measurable than success or temper.[5]

If we compare these results with those found for

[1] Contingency. [2] Four-fold method.

[3] Means of characters exclusive of eye colour.

[4] *Phil. Trans.*, vol. 195, A, p. 114 et seq.

[5] A fuller discussion of the cousin data will be found in Memoir IV of the *Eugenics Laboratory Publications.*

cousins we see that the resemblance is practically the same; that is to say cousins resemble one another as closely as uncles and aunts resemble their nephews and nieces. If, then, the undesirability of marriage within certain degrees is founded on the closeness of resemblance between individuals, the law which forbids the marriage of uncle and aunt with niece and nephew should also restrict the marriage of first cousins.

The result that cousins are as like as uncle and nephew seems at first sight as paradoxical as the result that parent and offspring are as like as brother and sister, because in two cousins there is an additional factor—the parent of one of the cousins—which plays no part in the relation of uncle and nephew. This objection seemed so great to Sir Francis Galton that the publication of the memoir dealing with the resemblance of uncle or aunt to nephew or niece was suspended until further investigation could be made into the matter. The line this investigation took was of the following kind: We asked, Are these facts, paradoxical as they may seem, really opposed to any theory of alternate or of blended inheritance? It turned out on theoretical investigation that they were not so. In 1909[1] Prof. Pearson showed that even on the Mendelian hypothesis the gametic correlation of brother and sister would be identical with that of parent and child in a Mendelian population mating at random. In 1910[2] Mr. E. C. Snow, of the Biometric Laboratory, showed that in a like population the correlation of first cousins would be equal to that of uncle and nephew. It may be objected that these papers proved the equality of the gametic correlations, and that the resemblances

[1] *Royal Soc. Proc.*, B., vol. 81, p. 225, 1909. [1] Ibid., B., vol. 83, p. 37, 1910.

dealt with were somatic. But this is really not to the point, because the writers by no means accept either the Mendelian principle of dominance or the Mendelian theory. Their object is to show that the apparent paradox found by the reduction of observations is *only apparent.* It is not a valid argument against the accuracy of the numerical results, for it no longer appears as a paradox, but as a result, hitherto not anticipated, which flows from Mendelian and probably any other theory of alternate heredity, namely that the resemblance of cousins can be as intense as that of uncle or aunt to nephew or niece, or indeed of grandparent to grandchild. We had found these results from actual observations of the somatic characters; theoretically we see that Mendelism would predict the same result for the gametic characters. If the gametic likeness of these three classes of relationships be the same, it would undoubtedly lead us to the conclusion that as far as danger arises from latent characters in the marriage of near kin then the marriage of first cousins appears to be as undesirable as the marriage of uncle and niece, or of grandparent and grandchild.

The unions of parent and offspring and of brother and sister would, however, appear—assuming gametic resemblance to be the ultimate source of danger—to be on a different plane from those already referred to. Considering the extreme rarity of such unions, there is some evidence for their physiological, as apart from social undesirability in the fact that we have come across several of them in our quest for the pedigrees of albinos and other abnormalities.[1]

[1] Even in this matter we have probably reached a minimum of actual cases, because parentage is carefully screened in such cases.

The following harmful results are usually urged by opponents of consanguineous marriages:—

(i) Marked decrease in fertility.

(ii) A high infantile mortality.

(iii) The occurrence of deaf-mutism, insanity, albinism, hare-lip and other deformities with greater frequency among the offspring of such marriages than among the general population.

Of these asserted baneful results of cousin marriages the first seems to have attracted special attention from the opponents of consanguineous marriages.

Pope Gregory the First declared that marriages between near kin proved sterile. That this argument against such marriages had been widely used seems probable from a letter of Simon Dugard on *The Marriages of Cousin-Germans vindicated from the censures of Unlawfulness and Inexpediency*, published in 1673, where he gives as the fourth objection to such marriages 'the ill prospering of them', and says that it has been urged that 'a Want of Children and a Barrenesse' follows such marriages. Dugard answers the objectors by pointing out that such want of children also often follows non-consanguineous marriages, and goes on to say that if cousins do have smaller families it may not be an unmixed evil, since 'I might, Sir, mention the great affliction that some men have from children when their number increases and they have not withall to breed them up answerable to the Love they have for them'.

To this question as to the decrease in fertility and to the second question as to a high infantile mortality I can find no complete answer; both are vehemently denied by some and as vehemently asserted by others; but I have failed to discover any really satisfactory

statistics on which to base conclusions. A high infantile mortality is found among the Todas and is asserted to be the result of cousin marriages which are prevalent among them, but Dr. Rivers, in a work published not long ago, says that there is little doubt that infanticide is practised by these people.

Sir George Darwin, in a paper published in the *Journal of the Statistical Society* in 1875, dealt with this question and compared the fertility of the marriages between first cousins and of the marriages of their offspring, as recorded in the pedigrees in Burke's *Landed Gentry* and the *Peerage*, with the fertility of marriages between persons not akin. The chief difficulty in the comparison is that the lists of daughters are very incomplete and that sons dying in infancy are frequently omitted, so that the comparison is only between the number of sons in each case.

Sir George Darwin gives the following table of results; he uses 'sterile' to mean 'absence of children surviving infancy':—

Parentage	Average Number of Sons to each Marriage	Percentage of Sterile Marriages	Average Number of Sons to each Fertile Marriage
Not consanguineous	1·91	15·9	2·26
Parents first cousins	between 2·07 and 1·92	between 14·7 and 20·9	2·43
One Parent the offspring of a marriage between first cousins	1·93	17·2	2·34

Sir George Darwin states that 'the figures in the second column are not of much value, since in some cases it was difficult to decide whether the entry should be made as being a case of "no information" or of sterility'.

A comparison of the figures in the first and last columns shows that the alleged infertility of consanguineous marriages cannot be substantiated. The only evidence that we can give confirms this conclusion. This evidence is from the large collection of pedigrees of albinos collected by Pearson and Nettleship. Among these pedigrees of albinos there are 118 families in which the parents are known to have been related, and 224 where it is known that they were not related; the average number of children to the family when the parents were related is 5·6 and when the parents were not related is 5·4, so that in albinotic families we may say that a cousin marriage does not result in a diminution in fertility, but there is no evidence as to whether absolute sterility more often follows a consanguineous than a non-consanguineous marriage. The collection of pedigrees in the Galton Laboratory is growing, and we are looking forward to the time when we shall have a large enough collection of completed pedigrees to enable us to answer this question of sterility and the question of a high infantile mortality among consanguineous marriages.

I have recently read a paper by Mr. Arner on 'Consanguineous Marriages in the American Population'.[1] He has worked largely on the genealogical records of American families, and he states that the material is very accurate in regard to the number of births, youthful death-rate, &c. To estimate the youthful death-rate he has taken all persons who die under 20, so as to include all those who are said to have 'died young', and he finds that of the children of first cousins 16·7 %

[1] Submitted for the degree of doctor of philosophy in the Faculty of Political Science, Columbia University, 1908.

died under 20, of other cousins 14·9 %, and of non-consanguineous marriages only 11·6 %. This looks as though there may be some truth in the contention that the children of cousin marriages have a lessened vitality which shows itself in a higher youthful death-rate.[1]

Sir George Darwin, in the paper to which I have referred, has attempted also to deal with this question, but does not regard the results he obtained as satisfactory or of great value, as he had to base the percentage of children dying young on only 37 first-cousin marriages. Sir George Darwin concludes that, so far as his inquiry goes, 'it tends to invalidate the alleged excessively high death-rate amongst the offspring of cousins, whilst there remains a shade of evidence that the death-rate is higher than amongst the families of non-consanguineous marriages.'

We will next consider the last objection to cousin marriages, and try to discover whether deaf-mutism, albinism, insanity, and kindred defects occur more frequently among the children of cousin marriages than among the children of non-consanguineous marriages. Or, to put the question in another way, assuming that we know the proportion of cousin marriages to all marriages in the population, is the proportion of cousin marriages in any special class of the community, i.e. among stocks with insane, deaf-mute, or albinotic offspring, greater than among the ordinary population?

First, then, what is the proportion of cousin marriages in the general population? We must at once admit

[1] It must be remembered, however, that the frequency of cousin marriages varies very much with class and environment. It is probably more frequent with rural than with urban populations, and such populations are usually differentiated in infantile death-rates.

that we do not accurately know. When the Census Act of 1871 was passing through the House of Commons Sir John Lubbock and others attempted to have the question inserted as to relationship before marriage, but the proposal was somewhat scornfully rejected, and consequently we have to fall back on various estimates of the proportion of cousin marriages.

Sir George Darwin, in the interesting paper to which I have already more than once referred, attempted to answer this question by an interesting and ingenious but rather indirect method.

In looking through marriages announced in the *Pall Mall Gazette* he noticed the announcement of a marriage between persons of the same surname, and as the number of surnames in England is very large he came to the conclusion that the number of same-name marriages would afford a clue to the number of first-cousin marriages. Sir George Darwin found that about one same-name marriage in a thousand takes place in which the parties concerned are unrelated, and as he does not pretend to have attained results of an accuracy comparable to ·1 % he says that he considers that when a same-name marriage takes place it is due to the consanguinity of the parties.

The next step was to count the marriages announced in the *Pall Mall Gazette* in 1869–72 and in part of 1873. The number was found to be 18,528. Out of these 232 were between persons of the same surname, that is, 1·25 % were same-name marriages.

He had next to determine—

(1) What proportion of this 1·25 % were marriages between first cousins and what proportion were marriages between more remote cousins.

(2) What proportion marriages between first cousins of the same surname bear to those between first cousins of different surnames.

From Burke's *Landed Gentry* Sir George Darwin found that the percentage of same-name marriages was 1·5, and of this percentage ·75 were marriages between first cousins and ·75 were same-name marriages not between first cousins.

From a large number of circulars sent out to the upper middle and upper classes, which sought information as to the number of cousin marriages in each family, returns showed a percentage of 3·41 first-cousin marriages, of which 1·38 were same-name marriages. From these same circulars it was found that there were 66 same-name first-cousin marriages to 29 same-name marriages not between first cousins, which is rather more than two to one and which disagrees with the results found by aid of Burke. From this Sir George Darwin concludes that probably 'a considerable number of marriages between persons of the same surname, not being first cousins, escaped the notice of my correspondents'.

Combining the results obtained from Burke and from the circulars the proportion between same-name cousin marriages and all same-name marriages was found to be 142 to 249, i. e. ·57, roughly $\frac{1}{2}$.

From the same data Sir George Darwin finds the proportion of same-name cousin marriages to different-name cousin marriages to be nearly 1 to 3, but he considers this proportion not accurate owing to various points in connexion with the schedules returned, and from the consideration of another series of schedules he thinks that on the whole it may be asserted, that the same-name first-cousin marriages are to the different-

name first-cousin marriages as 1 to 4; and applying the two proportions ·57 and $\frac{1}{4}$ to the 1·25 marriages of the *Pall Mall Gazette*, Sir George Darwin finds that there were 3·5 first-cousin marriages in the middle classes; if the same proportions be applied to the peerage and to the landed gentry the proportions of first-cousin marriages are found to be $4\frac{1}{2}$ % and $3\frac{3}{4}$ % respectively.

Sir George Darwin then applied the same method to the statistics of marriages obtained from the General Registry of Marriages at Somerset House, and found that in the London Metropolitan Districts the percentage of first-cousin marriages was $1\frac{1}{2}$, in rural districts was $2\frac{1}{2}$, and in urban districts was 2.

The Eugenics Laboratory has itself made some direct investigations into this matter. The proportion of cousin marriages among the parents of the patients at Great Ormond Street Hospital, where inquiry was for some years made as to the consanguinity of parents, was found to be 1·3, and from an inquiry addressed to doctors through the *British Medical Journal* by Prof. Pearson the percentage of cousin marriages was found to be 4·7; this proportion refers to the middle classes only, where the percentage of cousin marriages is certainly higher than in the working classes. It will be seen at once that Professor Pearson's 4·7 % for the professional classes does not differ widely from Sir George Darwin's 4·5 % for the peerage and 3·75 % for the landed gentry, while the 1·3 % from the Great Ormond Street returns is close to Sir George Darwin's 1·5 % for the London Metropolitan Districts; thus direct inquiry and the indirect method of surnames tend to confirm each other. To sum up, we may say that it seems unlikely that the percentage of first-cousin marriages can be

greater than 3 among all classes in England. In Ireland it is probably lower owing to Roman Catholic influence; while in the United States we should imagine it would be lower still owing to public opinion and the law, which in some states makes cousin marriages illegal. Dr. Peet of New York estimates cousin marriages to be 2% of all marriages. Mr. Arner, in the paper already referred to, finds ·5% to 5% in some few isolated districts to be the number of cousin marriages, and states that the average of first-cousin marriages in the United States is probably not greater than 1%, but I am not clear as to how he reaches these figures.

In considering the proportion of cousin marriages among classes affected by some special disease the only satisfactory statistics I can find dealing with numbers of any size have reference to deaf-mutism and albinism. There are also some statistics as to mental unsoundness collected by Sir Arthur Mitchell in Scotland, to which I shall refer later.

We will first consider the case of deaf-mutism. I hoped great things from the Irish Census returns, but on the whole they were disappointing. In the 1851 census 3,415 families were investigated in which one member was a deaf-mute, and inquiries were made about 170 cases in which the parents were consanguineous, but as far as one can tell there may have been other cases of consanguineous marriages among the 3,415 families considered, and the same applies to the other census returns. If the 170 represents all the consanguineous marriages, the percentage of cousin marriages among deaf-mutes was 5·0 in 1851, 7·0 in 1861, 6·7 in 1871, 5·2 in 1881, and 10·1 in 1901, giving an average percentage of cousin marriages of 7%. I ought

to remind the reader that in Ireland among the Roman Catholic part of the population cousin marriages are forbidden without a dispensation, and certainly 7% is a much greater proportion of cousin marriages than we should find in the general population.

Dr. Buxton, of the Liverpool Institute for the Deaf and Dumb, in 1859 writes in the *Medico-Chirurgical Review* of that city: 'In an inquiry which I made some time ago, from a large number of persons, I found that about every tenth case of deafness resulted from the marriage of cousins,' and he goes on to say that Dr. Peet in America reached the same proportion.

From Mr. Fay's book, *An Inquiry into the Marriages of the Deaf in America*, I find, among the parents of deaf-mutes, 430 consanguineous marriages out of a total of 5,353 marriages, i. e. 8%.

It would seem, then, that cousin marriages do occur more frequently among the parents of deaf-mutes than in the general population.

I should like to refer briefly to the investigations in the case of unsoundness of mind carried out by Dr. (now Sir) Arthur Mitchell in 1865.[1] Dr. Arthur Mitchell examined the cases of 711 persons of unsound mind in 9 counties in Scotland. In 192 cases the parentage was unknown. Of the remainder 98 were the children of consanguineous marriages and 412 of non-consanguineous, i.e. in 18% of the cases the parents were cousins, 8% of them being first-cousin marriages. This is a far larger percentage of cousin marriages than among the general population, and tends to show that

[1] *Memoirs read before the Anthropological Society of London*, 1865-6, p. 414 et seq.: 'Blood-Relationship in Marriage considered in its influence upon the Offspring.'

consanguinity is an important factor in unsoundness of mind.

I have not had sufficient information in any of these cases to enable me to divide the children into two classes, i. e. (1) those who are the children of normal parents, and (2) those who are the children of defective parents, either deaf-mutes or insane. I think this distinction is an important one, as the question of cousin marriage becomes of far more importance when we consider the case of two persons, quite healthy themselves, but who belong to a stock tainted with some defect. When one or both of the cousins concerned is a sufferer from some defect we may take it for granted that no one would advise their marriage, but when both the cousins are quite healthy the real problem of cousin marriage arises.

There are some interesting statistics in an *Appendix to the Report of the Royal Commission on the Blind, the Deaf, and the Dumb*, 1889. A table is included showing all the children who were admitted to an American asylum for deaf-mutes from 1877–87 and had any deaf-mute relatives. From this table I have taken all the families where neither parent is a deaf-mute and found that there are 51. I know this is a small number, but the proportion of cousin marriages among those 51 pairs of normal parents who all had at least one deaf child is very striking.

There are 26 cases of consanguineous marriages and only 25 of non-consanguineous marriages, that is 50% consanguineous marriages among normal parents resulting in deaf-mute children, which is an enormous percentage. There seems little doubt that if there is any deaf-mutism in a stock, a cousin marriage, even when both parties are free from the disease, is most dangerous to the offspring. And in considering the question of

healthy or unhealthy stock it is not sufficient that the parents, brothers, and sisters of the individual should be sound, but the uncles, aunts, grandparents, and I would add cousins must also be taken into account in forming an estimate.

There is a pedigree of haemophilia among the pedigrees which have been published in the *Treasury of Human Inheritance*[1] which illustrates this point in a most marked way. In this pedigree we have an individual suffering from haemophilia; if we trace his pedigree back in the direct line to the parents, grandparents, &c., for five generations, we find not a single case of haemophilia. When, however, we examine the whole pedigree with all the collaterals in each line of descent, we find similar more or less isolated cases of haemophilia in each generation. Looking merely at the ancestry of the individual in question we should say that there was no evidence of haemophilic taint. Looking at the whole pedigree we see that haemophilia has been latent for six generations. No one can boast of a clean stock because his direct ancestors are free; a consideration of collaterals in each generation may, however, indicate that we are dealing with a stock in which grave defect is latent. The pedigree above referred to is of peculiar interest because it is complete for six generations, but the Laboratory possesses many pedigrees of four or five generations which teach the same lesson. That lesson is that cousins—and collaterals of all grades—are of immense importance in diagnosing the eugenic fitness of a given individual.[2]

[1] See vol. i, plate xxxv, gen. vi, nos. 55–57.

[2] Recently German medical authorities have been insisting that genealogies, to be of service for medical diagnosis, must be carried back through all lines of *direct* ancestry (i.e. not only through the male line). Such

We may now turn to the discussion of consanguineous marriages in albinism, and here we have a very complete set of pedigrees and in sufficient numbers to give definiteness to our results.

In this case we can separate albinotic children into two groups: (1) those who are the children of an albinotic marriage, that is to say one parent is an albino, (2) those who were the children of normal parents, and see the frequency of consanguineous marriages in each case.

In the first case, that is when one parent was an albino, there was consanguinity in 11% of the families, or, if we consider the offspring, 31% of the albinos were children of a consanguineous marriage. In the second case, where the parents were both normal, there was consanguinity in 24% of the families, or, judging by the offspring, 29% were born of consanguineous parents. This shows, just as we found in the case of the deaf-mutes, a very high percentage of cousin marriages among the normal parents of albinos, a far larger proportion than in the general population. We can have no doubt that a cousin marriage plays a large part in albinism, and that even normal parents, if a cousin marriage takes place, will, if there be albinism in the family, pass on that albinism to their offspring.

We may next consider the question in another way. When cousin marriages occur among deaf-mutes or albinos is there a larger proportion of deaf-mutes or albinos among their offspring than among the offspring of a non-consanguineous marriage?

genealogies are, however, quite idle, as the above instance indicates; they fail to show that population of collaterals from which alone we can attain to even partial knowledge of the latent defects of an apparently hale ancestry.

Mr. E. A. Fay, in America, in the book to which I have already referred, finds that when the parents are consanguineous, one or both being deaf, 30% of their offspring are deaf-mutes, and when no consanguinity is reported only 8% of the offspring are affected—nearly four times as many children are affected when the parents are consanguineous and one or both deaf-mute.

The difference in albinism is nearly as striking. When one parent is albinotic 32% of the children of a consanguineous marriage are albinotic, and only 14% where the parents were not related, and nearly half of the 14% are only partial albinos. In the cases where there was uncertainty as to consanguinity we find, as we might expect, an intermediate percentage, i.e. 19%. Thus, while the marriage of an albino with a person not related means albinism for $\frac{1}{7}$ of the offspring, the marriage with a blood relative means albinism for $\frac{1}{3}$ of the offspring.

When we turn to the case where neither parent was an albino we find that among consanguineous marriages resulting in albinism 40% of the children were affected and among non-consanguineous marriages only 34%; and again, of the 34% albinos from non-consanguineous marriages a large proportion are only *partial* albinos, i.e. 23%, while from consanguineous only 10% were partial albinos.

It will be evident, then, that when the stock is albinotic, consanguinity of the parents immensely increases the incidence of albinism.

It has been suggested that a cousin marriage between the children of a brother and sister might have a less disastrous effect than the marriage of the children of two brothers or two sisters. To investigate this point very complete family histories are required; we have

found the number of albinos, partial albinos, and normal children resulting from each kind of marriage, and the results are given below:—

Marriage between:	Albinos	Partial Albinos	Normals	Percentage of Albinos, omitting Partial	Percentage of Albinos, including Partial
Children of Brothers	20	2	41	31·7	34·9
,, ,, Sisters	19	3	51	26·0	30·1
,, ,, Brother and Sister	47	16	122 or 123	25·4	34·1

These numbers are obtained from only 9 families of the children of brothers, 12 of the children of sisters, and 27 of children of brother and sister, but as far as they go they show practically no difference in the percentage of albinos arising from these marriages.

It has often been asserted that even in initially healthy stock excessive in-breeding will ultimately produce grave defects. In the case of man very little is really known as to the effects of in-breeding, though it is very customary to attribute to it all ills which arise in shut-in mountainous districts or on small islands. The question is rendered complex by the fact that any stock may appear thoroughly healthy and yet have latent defects awaiting their chance of becoming patent. If there be no such latent defect it seems very improbable that states like albinism or deaf-mutism will appear as the result of a single cousin marriage, but if the in-breeding be continued for several generations is it possible that defects will at last appear? The Mendelian would explain such appearance as the result of an ultimate union of two hybrids, the defect itself being recessive. But an examination of many pedigrees

of defects seems to indicate that they fall into two classes, the first, in which the defect reappears in isolated members generation after generation, and the second, in which the same defect appears for the first time with no discoverable trace of it in any direct ancestry or collaterals, even if our knowledge of them extends to several hundreds of individuals. The question mooted above as to whether in-breeding in man would ultimately be harmful might perhaps be answered by studying the second class of pedigrees, and inquiring if consanguineous marriages appear in them beyond their usual frequency in the general population. It is impossible to argue from single instances, but I have one pedigree in mind which suggests that an inquiry of this kind might be of special interest. The pedigree is a singularly full one, extending for more than six generations, with an immense number of collaterals. Cousin marriage is almost traditional in the stock, but there has been no evidence of any evil result until the present generation. Now, after at least six generations of intermarriage, we have an outbreak of albinism and pseudo-hypertrophic muscular affection. There is no proof that it is due to the in-breeding, but the suggestion is sufficiently strong to make one believe that the study of 'isolated case' pedigrees from the standpoint of the frequency therein of consanguineous marriages might be of very considerable value.

So far, then, as the statistics at present available allow us to draw conclusions we may sum up as follows:—

(i) There is no evidence at present to show that a diminution of fertility necessarily follows on a consanguineous marriage.

(ii) The question of whether there is more absolute

sterility in marriage of kin must remain unanswered until a far larger collection of complete family pedigrees are available.

(iii) There is some evidence to indicate that child mortality is greater among the offspring of cousin marriages than among the general population. But the evidence is not very conclusive, and it needs re-examination from the standpoint that the mortality of infancy and childhood varies from class to class, and from rural to urban populations, but the frequency of consanguineous marriages varies also from class to class and from one section of the population to a second.

(iv) There is quite definite evidence that the frequency of consanguineous marriages is greater among the parents of albinos, deaf-mutes, and persons of unsound mind than among the general population. If this holds for these three classes of defects, it holds in all probability for a far larger range of pathological states.

(v) If the offspring are affected and one parent is an albino or a deaf-mute, a consanguineous marriage more than doubles the number of children affected by the abnormality.

(vi) If the offspring are affected and both parents are normal, then a consanguineous marriage markedly increases the number of affected children and the intensity of the defect.

Now a study of these results, and the oft, if vaguely, expressed statement of 'clinical experience' that the marriage of even healthy cousins may be followed by the appearance of abnormalities and pathological defects, pressed upon us the conclusion that defects like albinism and deaf-mutism, relatively rare in the community, resulted more frequently from cousin than from non-

consanguineous marriage, and that when they did appear they appeared with greater frequency and in greater intensity. The same conclusion, but in a less marked manner, appeared to be true of insanity. Accordingly our observations led us to formulate a principle of the following kind: There is a very large number of latent defects in the community; these do not become patent except when intensified by the appearance of the like latent defect in both parents. When the defect itself is frequent in the general population, then it receives relatively small increased frequency owing to the marriage of cousins, but when the defect is extremely rare, then those cases in which it appears in the offspring of cousins contribute a large share to its total frequency in the population. The suggestion at once arose that in the germ-plasm of man as it is at present constituted there exists in latent condition a very large number of pathological defects. In the marriage of non-kin these defects are practically harmless; they are very unlikely on account of their rarity to be common to both parents, and will not therefore be intensified and so become patent in the offspring. In the case of marriage of kin, however, the probability of like latent defects in the germ-plasms of both parents occurring becomes much increased, and we find, as in insanity, deaf-mutism, and albinism, a contribution due to cousin marriage increasing directly as the frequency of the abnormality becomes less in the population at large.

The temptation, of course, is at once to express these observational results in the language of Mendelian theory or in terms of dominant and recedent alternatives.[1]

[1] Some aid in this direction would undoubtedly be reached if we recognized that dominance did not attach to the character but to the

We were restrained from doing so, not only by the fact that Mendelism seemed inapplicable to deaf-mutism, but that in the albino families in which albinos occurred among the offspring there was a larger number of albinos and more complete albinism where the parents were consanguineous. In both cases, however, the albinism of the offspring is evidence of the heterozygous character of both parents, and from the Mendelian standpoint the addition of consanguinity should not affect the numerical result, but only serve to account for the common heterozygous nature of the parents.

It is, however, always instructive when an observational result leads to a conclusion not wholly, nor hitherto fully, recognized, to investigate whether a current theory supports or contradicts such a conclusion. This matter has been considered by Mr. S. M. Jacob in a most interesting paper published in the *Royal Society Proceedings* (vol. 84, B, pp. 23–42, 1911), entitled: 'In-breeding in a stable Mendelian Population with Special Reference to Cousin Marriage.' Starting from Mr. Snow's results referred to on p. 15 above, Mr. Jacob supposes a simple Mendelian population to show a given recedent character in a certain number of individuals, the domi-

individual, i.e. that the same character can in certain individuals be dominant and in others be recedent. The selective disappearance of individuals in whom a detrimental character was dominant would lead to the character itself being ultimately found to be nearly universally recedent, and so to the idea of dominance or recedence attaching to the character rather than to the individual. Some such idea would account for the same two characters, or different intensities of the same two characters, not falling into the same class: thus partial albinism appears to be dominant, but complete albinism recedent. A white lock or patch is small detriment, complete albinism a severe handicap. Again, a study of night-blindness seems to indicate that it is sometimes dominant and sometimes recedent. Cases like deaf-mutism, in which no effective application of Mendelism seems possible, are perhaps explicable on the ground that selection has not yet made the detrimental character uniformly recedent.

nant character in a further certain number of individuals, the remainder of the population being heterozygous, or possessing the character in a latent condition. It is well known that such a population becomes with random mating stable in the third generation, and Mr. Jacob then proceeds to question the frequency with which the recedent character will appear patent in cousin marriages and in non-consanguineous marriages. Mr. Jacob's conclusion is that for a rarely occurring evil, which is recedent, consanguinity will have a marked effect.

The following abbreviated tables will indicate the nature of Mr. Jacob's results [1]:—

I. Percentage of Individuals of Patent Recedent Character who are the Offspring of First Cousins.

Percentage of Cousin Marriages	Percentage of Character in General Population										
	25%	10%	5%	4%	3%	2%	1%	·1%	·01%	·005%	·0001%
1%	1·12	1·27	1·43	1·49	1·59	1·75	2·12	5·02	12·6	17·1	69·6
2%	2·25	2·52	2·85	2·97	3·17	3·47	4·18	9·22	23·5	30·9	87·6
3%	3·37	3·79	4·26	4·45	4·73	5·19	6·24	13·5	33·0	42·4	93·5
4%	4·48	5·03	5·66	5·92	6·28	6·88	8·24	17·6	41·3	53·9	96·3
5%	5·60	6·28	7·04	7·35	7·80	8·55	10·20	21·6	48·4	59·5	97·8

[1] We have selected the case in which the general population is supposed to be a random sample of the population which would arise from every possible combination of the gametes of each pair of parents.

This table is most instructive; it shows that in the social classes where a high rate of cousin marriage exists a very large percentage of individuals with recessive defects may be expected to arise from cousin marriage. Thus if the Mendelian theory were correct, then in the professional classes with 3% to 4% of cousin marriage, we might expect to get rid of between 40 and 50% of the albinism occurring in these classes by the abolition of cousin marriage (albinism occurs in about 1 in 20,000, i. e. ·005% of the population). Actually, as we have seen above, about 29% of albinos of all classes result from consanguineous marriages. Again, tuberculosis, supposing its constitutional basis were hereditary, would be due in the professional classes to the extent of 4% to 6% to cousin marriages, and such marriages would contribute slightly more to the total of insanity.

But the total due to cousin marriage is perhaps not so interesting as the relative rates of production, which are given in the second table cited below from Mr. Jacob's memoir.

II. Relative Rates of Production of Individuals of Patent Recedent Character in the Marriage of First Cousins and in the General Population.

Percentage of Cousin Marriages	Percentage of Character in General Population										
	25%	10%	5%	4%	3%	2%	1%	·1%	·01%	·005%	·0001%
1%	1·12	1·27	1·43	1·50	1·60	1·76	2·13	4·90	14·1	20·2	226
2%	1·13	1·27	1·44	1·50	1·60	1·77	2·14	4·98	15·0	21·9	357
3%	1·13	1·27	1·44	1·50	1·60	1·77	2·15	5·06	15·9	23·8	498
4%	1·13	1·27	1·44	1·51	1·60	1·77	2·15	5·14	16·8	24·9	649
5%	1·13	1·27	1·44	1·51	1·61	1·78	2·16	5·22	17·8	27·0	801

Now this table is very significant; it shows us that when defects of the recedent kind occur with a frequency of 4% to 5% in the general population, then cousin marriages produce these defects at a rate half as great again as non-consanguineous marriages; that with a defect having a frequency of 1% in the general population the cousin marriages produce at double the rate of the non-consanguineous marriages, while in a case like albinism, occurring in about 1 in 20,000 of the population, cousin marriages produce at 20 to 25 times the rate of non-consanguineous marriages. Finally, in a rare recedent character which appears only once in 1,000,000 cases, the probability of an affected

individual occurring is 200 to 800 times more likely among the offspring of cousins than of non-kin.

It will thus be seen that Mr. Jacob's results confirm in rough outline, at least for one popular theory, the results of observation. The real danger of cousin marriage lies not in the existence of patent defects in the stock. Nor can we recommend cousin marriage because the stock has certain patent valuable characteristics. Behind the obviously advantageous quality may exist the rare but latent defect. The danger of cousin marriage lies in the probability that the germ-plasm of each individual contains numerous latent defects, each of which is rare in the community at large, and each of which is of small danger to the individual or the offspring unless the mating is with another individual whose germ-plasm contains one or more of the same latent characters.

It is perfectly true that the study of an ample pedigree, extending for five or six generations *with all the collateral kin*, may enable us to ascertain definitely by patent illustrations the existence in the stock of a latent characteristic. But its non-appearance, even in such an exceptional pedigree, cannot be taken as wholly satisfactory proof of the non-existence of this defect or of other latent defects. And, after an examination of the evidence at present available, we feel justified in asserting that in the bulk of cases cousin marriage is undesirable, even in those instances where the individuals can boast of an apparently normal and healthy ancestry and collateral kinship. The one exception we would make is in the case of the occurrence of some very rare good quality, which is peculiar to a stock, and which cannot easily be preserved for social profit except

by marriage of kin. In such a case, and in such a case only, does the risk to offspring, which appears demonstrated by our present inquiry, seem to find its justification.

The relative social advantages of exogamy and endogamy can perhaps be illustrated by the material of this paper, and the prevalency of exogamy justified by our conclusions; but that endogamy should at one time have been widely prevalent among primitive mankind may possibly also receive justification, when we remember that primitive man was probably more variable and there was greater need to fix racially desirable characters by segregation and selection. It is conceivable also that in an earlier period of natural selection the relationship between a detrimental character and recedence was not so close as it appears to be in some cases to-day, and that then the patency of such characters would be obvious warning against the non-eugenic character of many endogamous unions—a warning we now lack.

In conclusion I should like to express my indebtedness to Professor Pearson for much help in the preparation of this lecture.

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